



## Materials Engineering Branch

### TIP\*



#### No. 026 Effects of Ultrasonic Cleaning of Ball Bearing Components

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Rolling element bearings should not be subjected to ultrasonic cleaning in the assembled state. Ultrasonic cleaning of assembled bearings can damage raceways causing both reduced life and rough operation of the bearing. The vibration of the bearing components induced by the ultrasonic cleaning can cause small depressions or scratches on the rolling elements or the raceways. As the rolling elements pass over a damaged area, a small load spike will occur. In addition to the vibration associated with load spikes, the damage may propagate. For the same reasons, disassembled bearing components should not be cleaned ultrasonically in hard (e.g.: glass) containers.

At least one popular, but questionable, treatment being given to some spacecraft ball bearings is that of high temperature soaking in tri-cresyl phosphate (TCP) that is aimed at the production of a low-friction film on the bearing surfaces. This treatment requires several ultrasonic cleaning steps in various solvents before and after the soak and these can result in the surface damage mentioned. It is much more effective to add the TCP to the oil or grease which will then place it at the surface of the bearing components to react with newly created fresh metal micro surfaces as they are created during abrasion and contact. A quantity of 2-5% by weight of TCP should be adequate for development of the low-friction film and to maintain considerable life in vacuum at normal spacecraft temperatures.

**Caution:** As TCP is insoluble in the per-fluorinated polyester oils, it should not be used as an additive to these oils, nor should it be used to pre-condition (coat) components that will be lubricated with per-fluorinated polyester oil. The reader is encouraged to read TIP 070 titled: "Enhancing Lubrication with TCP".